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OF THE

Department of Agriculture

For the Year 1931.

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DEPARTMENT OF AGRICULTURE.

Report for 1931.

PART I—AGRICULTURAL ADMINISTRATION AND PROGRESS.

ORGANIZATION.

One appointment as Agricultural Officer was filled at the end of the year with the arrival of an officer specially trained in citriculture to provide adequately for the executive work at Newton Fruit Farm. Of the former staff of the Fruit Farm the Manager was seconded for duty elsewhere pending abolition of appointment, and the services of the Assistant Manager will be dispensed with early in 1932. The number of Agricultural Officers for the general work of the department is five; but with one officer permanently in charge of Njala Agricultural Station four only are left for the important district work, a number which is quite inadequate for the needs of the Protectorate and Colony.

The total provision for the direct work of the department decreased from £27,753 in 1930 to £26,142, the sums of £15,268 and £14,560 being in respect of personal emoluments and £12,485 and £11,582 for other charges in each case. The total provision for salaries and allowances of the European Administrative, Research and Field staffs was £8,139, the respective percentages being 29, 32 and 39: figures that again draw attention to the proportionate shortage of field officers.

The expenditure approved under Surplus Balances for providing experiment and demonstration in plantation agriculture was £10,806, of which £7,239 was for Masanki Oil-palm Plantation, £180 for oil-palm plots at Njala and £3,387 for chiefly bananas and citrus at Newton Fruit Farm.

Provision for indirect aid in connection with the work of the department amounted to £1,590 in its estimates for contributions to the Imperial Institute (£575), Colonial Office Scholarship Fund (£270), Imperial College of Tropical Agriculture, Trinidad (£250), Imperial Bureau of Mycology, Agricultural Research Council, Imperial Agricultural Bureau, Locust Sub-Committee of the Civil Research Committee and the Handbook of the Flora of West Africa.

After the amalgamation of the Central and Southern Provinces it was found that a more effective system of agricultural work would result from a division of the territory into agricultural

circles; and therefore four such circles were constituted and designated Northern, North-western, Eastern and Western: each comprises the administrative districts in its area. In the absence of an officer for it the second of these was in charge of the Agricultural Officer, Northern Circle. The Eastern and Western Circles were constituted in April, and under the present arrangement the Colony Peninsula is included in the Western Circle.

On account of the acute financial depression and consequent lack of staff available for it, district work was greatly restricted, so that the principle of concentration in adjoining areas rather than diffuse effort was adopted. As shown in the Details of Assistance and Progress below, it is satisfactory to record that very considerable progress was made in areas in which Agricultural Officers were able most effectively and economically to concentrate their effort.

The extension of the work of the Agricultural Officer and the Agricultural Station through sub-stations (including nurseries and school-gardens) is regarded as the most important means of decentralizing agricultural assistance, and a useful beginning has been made in this direction in all circles.

GENERAL AGRICULTURAL ASSISTANCE.

Supplies and exchanges of planting material were made with twenty-five countries, of which seven were foreign, and of course Kew, the executive work falling most upon the successive officers at Njala Agricultural Station, with advice including that from the Mycologist. Tropical and sub-tropical countries are invited to co-operate still further in this important work, which is facilitated by the list of plants published in Appendix IV of the last report.

As shown below, the organized produce inspection by the department continues its usefulness; and there is increasing recognition of the fact that the provision of a produce inspection branch is not merely conventional or imitative, but for the purpose of improving produce so that its standard may bring a good price and protect the producer from the loss of demand or even of markets when lowered prices push low-grade produce out of competition. For this purpose the instructional side of the branch has been strengthened by direct co-operation with officers in charge of circles. To have gained a premium instead of a deduction of 2 per cent. for the palm kernels of the country, to have put an end to the bad reputation of its palm oil for adulteration, and to have brought piassava (from Sherbro) from £18 to £2 per ton below Calabar-Opobo, are not among the least of the achievements of the branch, all of which bring increased wealth to the country.

For guidance in the department and generally, and for obtaining uniformity of instruction in schools and colleges, two leaflets were published, Nos. 6 and 7, entitled Locusts and Help

to Coffee Growers, the latter being subsequently reproduced in the local press. This assistance of the local press is made large use of by the department, fifty articles, of which twenty-eight were on general agriculture and eleven each gave produce inspection and crop reports, having been published during the year. The co-operation of the Editors in this useful publicity is appreciated, and a greater speed of publication would enable the department to give yet more help.

In the more direct efforts for instructional agriculture, there now exists a definite system by which Agricultural Officers carry out follow-up work for assisting school-gardens, their activities being reported automatically to the Director of Education. Another advance during the year was the appointment, on the invitation of the Trustees, of the Director, and the Director of Education, to the Board of Management of Mabang Agricultural Academy (the Treasurer being collated as well in an advisory capacity). With the assistance of the other members of the Board of Management the teaching of the Academy is being organized in a practical manner to serve its purpose—the production of farmers; and the direct supervision of the agricultural work by the Agricultural Officer, Western Circle, should enable this to be carried out on stable lines having immediate relation to the Colony.

Work was begun for the purpose of renewing and adding to the exhibits in the Sierra Leone Court of the Imperial Institute, the executive part of it being chiefly in the hands of Mr. G. Tuach for exhibits and Mr. E. I. Nisbett for photographs for transparencies.

Efforts begun in 1930 resulted in the formation of the Sierra Leone Agricultural and Commercial Society for assisting agriculture in the Colony, the policy being to deal with the practical questions that require attention for its good, with the aid of citizens who are keen to give their personal assistance in these matters. At the same time the department was making enquiries regarding the feasibility of the introduction of unlimited liability societies for mutual aid among Colony farmers and received encouragement at this early stage by the opinion, given at a meeting of influential persons in the Colony with the Colonial Secretary, the Director and the District Commissioner, Waterloo, that such activities might usefully be pursued.

PROGRESS OF THE CHIEF CROPS AND PRODUCE.

This is summarized largely from reports furnished by the Agricultural Officers and the Inspector of Plants and Produce.

Abundant crops of the principal foodstuffs were harvested; indeed, it is doubtful whether food has been in any previous year more plentiful. Rice was particularly in abundance and prices unusually low.

Following the general condition, trade was exceptionally bad and prices ruled low; but an appreciable improvement set in at the close of the year, particularly in regard to oil-palm products. Kola was at times almost unsaleable, the price falling as low as 8*s.* a measure (176 lb.). After the low prices realized for the 1930–31 crop of ginger, the season opened in December with the reasonable price of $1\frac{1}{2}d.$ to $1\frac{3}{4}d.$ a lb. on offer.

Agricultural exports are shown in order of their value in the following table, in which comparison is also made with the exports in pre-war and war-boom years:—

Tons.

—	1913.	1923.	1930.	1931.
Palm kernels ...	49,201	59,545	56,641	54,462
Kola	1,865	2,545	2,271	1,584
Ginger	2,047	1,395	1,972	1,927
Piassava	839	1,620	2,417	3,150
Palm oil ...	2,571	3,346	3,652	1,359
Hides and skins ...	9,789*	10	4	31
Rice	798	9	175	177
Cacao	2	29	80	61
Benniseed	36	—	41	83
Peppers	9	147	111	13
Coffee	8	4	5	7
Raffia	—	—	6	$\frac{1}{2}$

*Leaves

Pounds Sterling.

—	1913.	1923.	1930.	1931.
Palm kernels ...	920,943	968,797	664,591	449,742
Kola	328,003	187,476	186,197	47,847
Ginger	35,468	46,236	57,228	32,518
Piassava	12,280	20,035	36,582	31,846
Palm oil	56,659	102,645	79,310	19,830
Hides and skins ...	4,249	723	2,296	1,689
Rice	3,991	205	2,151	1,596
Cacao	52	1,004	2,548	1,034
Benniseed	460	—	538	752
Peppers	565	11,818	4,421	552
Coffee	598	186	189	237
Raffia	—	—	316	22

It says something for the stability of the trade of this country: that 68,650 tons of this produce in 1923 had fallen only to 62,855 tons in 1931, although the change in total value was from £1,339,126 to £587,665, or considerably less than one-half.

LEGISLATION.

The following legislation dealing with agricultural matters was enacted during the period under report:—

Native Produce (Amendment) Rules, 1931 (No. 24 of 1931): for the purpose of excepting native producers from the payment of licence fees for selling produce.

Native Produce (Raffia) (Amendment) Rules, 1931 (No. 25 of 1931):
to enable strong raffia other than white to be exported (for tying vines, etc.).

Destruction of Locusts Ordinance, 1931 (No. 21 of 1931): to help in obtaining the assistance of the public against locusts.

METEOROLOGICAL MATTERS.

Meteorological recording in agricultural stations was continued, and all other stations except in the Colony were taken over under inspection and guidance by the Agricultural Officers, their situation being as shown in Appendix II. The records, largely taken at schools where (as agreed by the Director of Education) they can be made to form an important part of the discipline, are increasing in steadiness and accuracy and becoming of use to the country.

REVENUE.

The details of this are given in Appendix III.

A. H. KIRBY,
Director.

PART II—DETAILS OF ASSISTANCE AND PROGRESS.

NORTHERN AND NORTH-WESTERN CIRCLES.

Owing to the absence of the substantive officer, Mr. R. R. Glanville, on an agricultural visit to the East, the Assistant Director of Agriculture, Dr. F. J. Martin, was in charge of the work during the greater part of the year.

To facilitate supervision by the Agricultural Officer and to reduce travelling expenses and time spent on touring, the district agricultural work has been concentrated as far as possible into definite areas, each provided with a small sub-station. Considerable progress was effected but much more would have been achieved had it not been for a very serious invasion of Locusts, for throughout the months of April–July, those of greatest agricultural activity, practically the whole of the agricultural staff was engaged in anti-locust work and was unable to attend to its ordinary duties. The invasion was the worst on record, and it is a matter

for congratulation that the damage to food-crops was so small: a happy result attributable to the rigorous manner in which control measures were prosecuted. The first swarms arrived in December, 1930, from French Territory on the north-east frontier; by February swarms had been reported from all districts, and until May they were frequent everywhere. Hoppers were first detected on April 27 and within a short time had been recorded from all districts; they continued to hatch out until the end of June. Control measures were effected and by the middle of July all hoppers had either been killed or had come to maturity and escaped into French Territory. The western half of the Northern Province was infested much more than the eastern plateau area: only to be expected, as the breeding grounds were chiefly confined to the low-lying grass-covered river flats of the coastal plain. In combating the hoppers, four methods were employed: trenching, poisoning, flogging and burning. Trenching was the cheapest and most satisfactory method when ample labour was available. Both paris green and sodium arsenite were used for poisoning, the latter being the more successful, especially when sprayed directly on to the hoppers. Poison bait, made by mixing the former with sawdust and a little salt, was not generally successful, possibly because of the abundance of alternative food, chiefly grass. Many small bands of hoppers were destroyed by flogging. When they were discovered in grass fields which had not been burned they were destroyed by fire. All available members of the local agricultural staff were detailed for this work and from the end of May until July an additional Agricultural Officer, Mr. Roddan, and six Agricultural Assistants were seconded from the Southern Province. The Administrative Department rendered invaluable aid and their co-operation smoothed out many difficulties. Two platoons of the Royal West African Frontier Force did excellent work in the Karene, Port Loko and Kambia Districts, and were responsible for the destruction of a large number of hordes. The local chiefs were usually quite willing to turn out men, especially at the beginning of the campaign; but later they required encouragement, except usually where crops were directly threatened. The work done is indicated as follows:—

Total number of hordes located and destroyed ...	1,279
Average size of hordes	1·5 acres
Total number of man-days worked	37,511
Number of hordes killed by trenching ...	633
Number of hordes killed by poisoning ...	315
Number of hordes killed by flogging	216
Number of hordes killed by burning	115
Total length of trenches dug	35,455 yards.

There was comparatively little damage done to crops as the swarms did not arrive until the bulk of the rice crop had been harvested. The most serious damage was caused by hoppers, but where this occurred it was generally because this department was not warned until it was too late to take preventative measures.

The presence of the hoppers, however, held up planting in some areas although in most instances it was possible to sow the rice sufficiently early to ensure a good crop.

The work done at Makump Sub-station is summarized as follows:—

Some of the old trees of Cacao (15–20 years) were badly diseased and have been cut out. Healthy trees have been retained for seed supply. 380 pods were distributed and 400 were fermented.

The Liberian Coffee has done very well and at five years of age has started to bear heavily. However, it has been decided to cut out this plot as chief attention is given to the more valuable Robusta kinds. Stenophylla Coffee is not doing well in one area and it is proposed to remove it. Another plot shows the best results on the more level ground. Canephora Coffee is now four-and-a-half years old and is only fairly good, probably because the heavy soil is insufficiently drained. Bananas planted to provide temporary shade were cut out because they were crowding out the coffee to some extent.

Fourteen different kinds of Cassava provide material for distribution, where advisable, and for observation. Mayugbe Cassava was also grown for demonstration purposes and for planting material; but after promising well, became rather heavily infected with a disease causing defoliation and "die-back" of the twigs.

The Kola is now five years old and making satisfactory progress. That grown without shade made little growth in 1930, but now appears to be established and steady progress is anticipated.

The recording of yields from Kawei Oil-palm was discontinued. Nigerian Oil-palm continues to make excellent progress and provides a splendid demonstration of what a young plantation should look like. It is now five years old and the first heads were harvested in November, 1930, the number cut during then and in December being 19. In 1931 the number was 153; these were collected from 38 palms which was the number bearing out of a total of 65 trees on the plot.

Six varieties of Sweet Potatoes planted in May failed to give any results because the situation was too damp. Six were also planted in another plot in September as a following crop to "fundi," in comparatively light and well drained soil; the crop is promising.

Three varieties of Yams—yellow, Chinese and Usuru are, except the last, from Nigeria, promising good results.

Guinea-corn failed, probably through heavy soil.

The progress of Coconuts was good; as also was that of Sisal.

An Irrigation Trial was made in the bottom of a small valley on the farm, on an area used from time to time for rice in the rainy season and for vegetable gardening and nursery work in the dry. There is a spring at the upper end of the valley and water continues to run for at least ten-and-a-half months of the year. The purpose was to demonstrate how, with simple controlled irrigation, it is possible to utilize the valley bottoms to greater advantage than is done at present. Shortly, the experiment has clearly demonstrated that, in the rainy season, wetland rice can be successfully grown in bunded valley lands whose only water supply is derived from direct rainfall, supplemented by seepage and " run-off " from the valley sides; and that in valleys where there is a perennial water supply it is possible to grow a great variety of crops in the dry season if the watercourse is directed to the side of the valley and utilized for the irrigation, by gravity, of the lower lands.

The Nursery Work was maintained, although on a smaller scale than in previous years. For distribution of planting material *see* Appendix I.

The chief Produce Harvested from the farm was Canary banana 67 bunches; plantain 56; cacao 780 pods; sweet potato 697 lb.; Nigerian, Chinese and yellow yams, 227, 1,449 and 1,188 lb.; oil-palm 350 heads.

The old nursery at Kabala Sub-station was extended to 1 acre and the following crops were grown for demonstration purposes and to provide planting material for distribution: upland rice 9 varieties; sweet potato 6; fundi 2; maize 4; ground-nuts 2; Chinese yam, yellow yam, coco yam, guinea-corn, Susu beans, Nigerian oil-palm and orange. They all did very well, and the local farmers were much interested.

A new nursery was made at Batkanu Sub-station, and seed of Nigerian oil-palm and canephora coffee has been sown, and plots of Canary banana and mayugbe cassava have been planted, all for planting material for distribution.

The old nursery at Port Loko Sub-station has been abandoned and a new one started in the Kamaranka valley where a perennial water supply is assured. Small plots of mayugbe cassava and Chinese yam, Canary banana and plantain were made; and the following were sown or planted with a view to raising material for distribution in 1932: coconut 200, kola 400, Nigerian oil-palm 3,000 seedlings, canephora coffee and cacao. Melekuri Sub-station is also new. Cacao, canephora coffee, Nigerian oil-palm, mayugbe cassava and Chinese yams are being raised for distribution.

The intensive District Work mentioned already was concentrated in definite areas within easy reach of the five sub-stations; outside these areas only general attention was feasible.

The locust work interfered with routine instruction as already stated; nevertheless, considerable progress was made.

All members of the staff continued to preach the cultivation of RICE in wetlands; and except in particular conditions where sudden flooding or sandy soils make it impracticable, the transplanting method has been taught as better than sowing broadcast.

Since 1927 this department, in co-operation with the District Commissioner, has supervised a scheme to encourage the cultivation of swamp rice in KOINADUGU. The transplanting method has been demonstrated and 100 bushels of seed rice has been lent each season to participants in the scheme. This year three new chiefdoms, Warawara Bafodia, Kasunko and Tamiso, shared for the first time. Some of the farmers having expressed a wish to try Pa D.C. rice in their farms, twenty-four bushels of seed were obtained from the Port Loko creek. The records show that, altogether, 165 and 225 bushels of Pa Litoma rice was sown in nurseries in ten and nineteen chiefdoms in 1930 and 1931, the Government supply in the latter year being 104 bushels; and that the similar figures for Pa D.C. rice were 24 bushels (all of Government distribution) in nine chiefdoms in 1931.

The policy of encouraging the villagers to grow the best varieties of their FOOD CROPS was sustained, and considerable quantities of planting material of mayugbe cassava, Chinese yam, yellow yam, Canary banana and plantain were distributed widely—in many cases in areas where these varieties had not previously been cultivated. The importance of this work cannot be too greatly emphasized.

The demand for CACAO seed has been sustained, and during the year forty-nine nurseries and two plantations were made in Bombali, Port Loko, Karene and Koinadugu areas under departmental supervision; whilst many others were made by farmers not yet recorded. As the instructors were busy on locust work at planting time it was not possible to give much assistance in 1931. A census of established plantations in the Bombali District showed that 35 per cent. of plantations had failed, 29 was medium in condition and 36 per cent. was good.

Farmers are showing an increased interest in COFFEE and it is thought that its area will increase considerably within the next few years. Unfortunately poor results were obtained from the seed supplied from Njala in 1931; but better are hoped for next year. The coffee recommended by the department for cultivation in the Northern Province is the canephora variety of robusta; Liberian or stenophylla will not be issued in future.

Since 1928 this department has been encouraging and assisting natives to make plantations of NIGERIAN OIL-PALM, especially in the areas where natural palm stands are absent or sparse. This

policy was sustained and extended in 1931, and 50 new nurseries and 15 new plantations were made in the Bombali, Port Loko, Karene and Koinadugu Districts, chiefly in the first and last.

Ploughing continues to make steady if slow progress. Some of the original experimenters have ceased to plough, but there are several new-comers who are working well. Taken as a whole the results are encouraging, but it is thought that plough owners will get better results if they reduce the areas ploughed and increase the number of ploughings: ploughing areas larger than what can be properly cultivated is to be deprecated. The position in 1931 was that seventeen farmers ploughed 133 acres in the districts just mentioned.

A shipment of Raffia made by Messrs. Rietmann and Axenfeld of Makeni was well reported on and fetched a good price. In November an Instructor toured Koinadugu teaching the correct method of preparing and marketing the fibre.

As regards Progress in Production, that of the chief food crops was good, and it is doubtful whether food has ever been more plentiful in the province. Both the upland and lowland rice were excellent and the area of the latter was apparently greater than in any previous year. Root crops too were excellent and the area planted was above normal. The fundi crop was normal but ground-nuts suffered rather more than usual from disease, probably because of a rainy season which was longer than normal. A few chiefdoms, mostly in the Karene District, had a slightly smaller area under crops than usual on account of locust damage; but this deficiency is negligible when the province is considered as a whole. Trade has been exceptionally bad and prices have been very low. At the close of the year a general improvement took place and it—particularly in palm products—became brisker. Kola was at times almost unsaleable and the price fell as low as 8*s*. per measure. It was exceedingly fortunate that there was no failure of food crops during this period of low prices. It is thought that the number of Cattle in the province increased during the year: there were considerable importations from French Guinea. Some of the herds in the Koinadugu District, and to a lesser extent in the Karene District, suffered severely from shortage of grass during the earlier months of the year as flying locusts often did much harm to the grasslands in the cattle areas. Not many animals died, but many were reduced to a very poor condition for some months.

It is hoped to devote an increasing amount of time and assistance to School-gardens. During 1931 the schools at Magburaka, Kambia, Binkolo and Kabala were assisted and advised at frequent intervals.

One hundred and thirty Herbarium Specimens were prepared and sent to Njala for the Departmental Herbarium, with duplicates

to Kew. They included collections representing the different varieties of Guinea-corn, cassava, sweet potatoes, beans, and tobacco grown in the province.

The names of fifty-two farmers were added to the FARMERS' RECORD during 1931, bringing the total number of those receiving direct regular assistance up to 314. This figure does not include the large number of farmers who receive intermittent assistance in the shape of planting material, but only those who are making farms and plantations with our practical assistance.

R. R. GLANVILLE,
Agricultural Officer.

WESTERN CIRCLE.

This was in substantive charge of Mr. P. J. Moss, Agricultural Officer, except for a period of leave from March 8 to October 10, when Mr. G. M. Roddan officiated. The latter was absent from the Circle from May 22 to July 5, comprising the most important agricultural period of the year, in connection with the locust campaign in the Northern Province. The Agricultural Officer of this Circle is at present in charge of the Colony Peninsula as well, as regards applications for seed and advice on farming.

As regards FOOD CROPS the Western Circle contains some of the most important RICE areas in Sierra Leone, not because it is specially suited to this crop, but because the existence of consuming centres such as Bo and Bonthe creates markets. In the year under report the crop was good, and partly as a result prices were unusually low. It may now be safely stated that all fear of a serious "hungry season" has been banished from the minds of the people forever; and it seems fair to record the opinion that the main factor in producing this result has been the teaching of wetland rice cultivation by this department, which teaching has enabled large areas to grow surplus, where formerly rice has had to be imported.

Wetland rice-growing has not made the same progress in the Western as in the Eastern Circle, mainly owing to the concentration of work in the Eastern Circle districts of the old Central Province. The coastal areas of the Western Circle are not so suited to this crop as are the hillier inland areas. In the coastal plains many swamps are stagnant and therefore unsuitable for rice, and again many are covered with piassava palms which make it undesirable to advise anything but piassava production here. Extensive mangrove forests await exploitation, but past efforts to interest the people have failed. Steady progress has been made in the Bo District and the north-eastern chiefdoms of the Moyamba District. Appendix I gives the details of supplies of seed-rice departmentally in this Circle.

It is necessary to state the main obstacle to the rapid spread of wetland cultivation at the expense of shifting cultivation which is, that although it is widely recognized by the people that better results are given by the wet method the typical peasant does not believe that he can grow his other crops pure. In other words the main reason for shifting cultivation is now the cultivation of cassava, cotton, benniseed, peppers and beans mixed in dry-land farms. It is therefore considered that so far swamp rice cultivation has not been at the expense of shifting cultivation, but supplementary to it, and that the evil continues undiminished.

The crop second only to rice as a foodstuff is Cassava. The varieties of this commonly grown in the Circle were determined and classified as slow-growing bitter, shenge, kande and tise; slow-growing sweet, pu-langei (various), mende-langei (various), kono-langei; quick-growing sweet, mayugbe. Two sweet, quick-growing varieties were introduced in 1930 (at Njala) by the writer, namely, two-cent (from Liberia), found growing at Zimi and Baiwalla, and red-skin (probably from Calabar, found in the Colony). Two-cent is very similar to mayugbe and may be slightly superior to it. The latter has spread from the Circle to the whole of the Protectorate during the last few years. It is highly-prized for its flavour and for its heavy crops.

Over a large part of the Circle a disease (cassava mosaic) is serious. So far it has not spread north of the railway, but there is evidence of a slow progress in a northerly direction. It is characterized by yellowing and crinking of the leaves, while the roots are small and bitter. In Bonthe Island probably 90 per cent. of the plants are attacked, and infection is on a similar scale along the coastal belt of sandy soils. The varieties suffering the severest attack are those in the bitter, slow-growing class, while mayugbe has not yet been noted suffering from mosaic disease outside Bonthe Island. Two possible ways of control are being followed: roguing standing crops and planting only sticks of uninfected plants; and substitution of varieties which appear to be less susceptible. The first way has against it the reluctance of the farmer to destroy a growing plant, and the belief that the disease is due to hot sun, and therefore that any plant will suffer. The second way does not promise quick results, as the farmer likes to have slow-growing varieties, which he can leave for a year or two, and the less susceptible varieties are the quick-growing ones. Probably the soundest and quickest way will be to establish clean plots in areas where the disease is rampant, and to maintain them free from disease before the eyes of all men. This work will be begun in 1932.

Preliminary arrangements have been made for investigating the possibility of control by sowing seed instead of planting sticks, as it is held by some that virus diseases are not transmitted through seed. If plants raised from seed of infected parentage

prove to be clean, an attempt will be made to introduce this new way of growing cassava. In order to separate strains of the mayugbe variety, a number of seeds from plant of this were sown in the Agricultural Officer's garden at the end of October, and one month later fifteen good seedlings had been produced which so far are of two types. They were transplanted and will be watched carefully. During transplanting the root systems were examined and photographed, and the following main characters of the two types are recorded here: (1) the more vigorous with petioles entirely deep-red, stem partly coloured, and few roots and thicker; (2) the less vigorous with petioles red on the upper surface only, stem pale-green and a large number of fine roots.

With respect to Plantation Crops, ninety-six plantations of robusta Coffee were laid out, averaging just under 200 trees. This may be regarded as satisfactory, though the condition of a number of the farms leaves something to be desired, owing partly to less suitable sites, and partly to lack of attention, the reason being the Agricultural Officer's absence for the locust campaign already mentioned. Plantations established in previous years showed good progress, though there was a tendency to neglect them as a result of the old " campaign " scheme of propaganda on communal lines. Most of the plots are found in the old Gbangbama and Sembehun Districts and their growth shows that robusta coffee is well suited to the country provided that shade is provided or left. This coffee grown without shade is certain to fail, and growers are constantly advised accordingly.

Fifty-seven nurseries were made during the year, averaging a little over half-a-pound of seed. A number failed completely—not an uncommon experience when coffee seed has to be transported long distances, and where there is considerable (and inevitable) delay between harvest and sowing. From 1932 onward supplies of seed will be available locally throughout the Circle, and therefore improved germination with more encouraging success will result. By December, 1932, a significant amount of coffee will be saleable by the growers. It is notable that the coffee so far produced is of better quality than that usually imported from other parts of West Africa.

Popular interest in Cacao has waned in recent years owing to failures when plantations were made in unsuitable sites and to the collapse in the demand. No recorded planting took place in 1931. There are many trees to be seen in small numbers in and around villages, but the fruit is used solely as a substitute for kola. Applicants would of course receive advice and assistance where the land is favourable, but they are rare nowadays as interest has been transferred to coffee.

The distribution of Nigerian Oil-palm seedlings was nearly 5,000. There is a constant demand for the Nigerian palm even from those living in areas rich in oil-palms, and such requests are satisfied as far as possible provided that no expense is incurred.

It is not possible to report any improvement in the methods of growing and preparing GINGER. Only minor improvements can be made until farmers have seen the wisdom of adopting methods which will produce larger rhizomes, and widespread improvement in cultivation cannot take place while much ginger is left in the ground for two years, as is the case when prices at the end of the first year are low. Growers are continually advised how to proceed if they wish to grow better ginger, but the advice has not yet borne fruit. Prices were low for the year 1930–31 crop, and as a result the amount of ginger in the ground at the end of the year was larger than usual. Harvesting was in full swing in December, and a reasonable price was offered: $1\frac{1}{2}d.$ to $1\frac{3}{4}d.$ per lb.

A very important part of the work of this Circle is SUPERVISION OF AGRICULTURAL TEACHING at the Mabang Agricultural Academy and the Protectorate Central College at Koyeima. A syllabus providing for a two or three-year course in agriculture was prepared for the former, under direction from and in consultation with the Director. This includes, in addition to crop husbandry, training in the breeding and management of poultry, for which it is intended to establish a flock of Rhode Island Red, imported from England after immunization to various diseases, all surplus birds to be sold: work that should effect a significant improvement in the poultry of the Colony in quite a short time. In further consultation with the Director, a syllabus of Nature Study and School-gardening for the Protectorate Central College, Koyeima, was drawn up. In this an attempt is made to make class-room teaching more real, and gardening more interesting, by correlation. It is hoped that this syllabus will furnish a foundation of all such teaching.

Various schools were visited from time to time and it is encouraging to record that teachers invariably welcome advice and assistance. Arrangements were made for the greater use of school-gardens educationally and agriculturally, and it is hoped that they will take effect in 1932.

P. J. MOSS,
Agricultural Officer.

EASTERN CIRCLE.

The Officer-in-charge of the Circle until December 7 was Mr. J. W. D. Fisher, who then handed over to the reporter.

When the Circle was constituted there was a small sub-station at Zimi; this was closed before the end of the year. No others were in existence during 1931, although arrangements and some small beginnings were made for the opening of one at Kenema and suggestion made for opening others at Pendembu, Kailahun and Segbwema, at one or more of which the ordinary work will be added to by demonstrations of irrigation in valleys to reduce shifting cultivation.

The distribution of Swamp Rice, as well as instruction in regard to it, was done for sixty-eight farmers in fifty-nine villages in fourteen chiefdoms in two districts, Pujehun and Kailahun, the number of bushels of seed distributed being 130. Instruction in areas where work of this kind had already been done was continued, and altogether as a result swamp rice cultivation is spreading rapidly and adding materially to the output of this very important crop.

The cultivation of Cacao is now so well known in this Circle that it is no longer necessary to keep up a sustained instructional planting propaganda; and during 1931 only six plantations in two chiefdoms in Kenema were made under the control of the department. The main work for this crop is for improving quality by instruction in fermenting the beans.

The department has been actively concerned in pushing forward the new industry of Coffee in this Circle. Only robusta has been encouraged and 159 nurseries and one plantation in sixteen chiefdoms in Kailahun, Kenema, Pujehun and Kono were established under its supervision.

Effort has been made to popularize the Nigerian varieties of Oil-palm and twenty-one nurseries and eleven plantations have been made under direct instruction in fourteen chiefdoms in Kenema, Pujehun and Kailahun. The size of the plantations varies from small plots containing a dozen palms or so to plantations containing 300 to 500.

Ginger was introduced into this Circle for the first time in 1931, 150 lb. of " seed " being distributed in the Small Bo and Nongowa Chiefdoms of Kenema and 56 lb. at each of Daru (Jawi) and Koidu (Bense); but it is yet too early to indicate results.

With a view to the propagation of a good kind of Cassava, in many areas which are in need of it, " two-cent " cassava, which is said to be at least partially immune to mosaic and also very palatable, has been distributed to twenty-two farmers in nine chiefdoms in Pujehun, the material being taken up very keenly.

The introduction of Chinese Yam into this Circle was begun during 1931, " seed " being supplied to twenty farmers in five chiefdoms in Kenema, Kailahun and Pujehun. Results are awaited.

It will be seen that a very definite start has been made to improve the agriculture in this newly-created Circle by encouraging the use of swamps for rice cultivation, by popularizing the production of coffee and cacao and by introducing new food crops, beginning with yams and cassava.

F. J. MARTIN,
Assistant Director.

PRODUCE INSPECTION.

In the absence of the Inspector of Plants and Produce—Mr. G. Tuach, the Assistant Inspector—Mr. F. W. Browning-Allinson, acted as Inspector from March 16 to August 31.

The Inspector accompanied the Director of Agriculture on a Tour of Inspection of the coastal areas of the Southern Province during the month of February. In November he made a tour in the railway areas of the Southern Province, chiefly with a view to encouraging the production of piassava. During December he made a tour of inspection of produce and weights and measures in the Port Loko District of the Northern Province.

Despite the very low prices offered during the greater part of the year a high standard of quality of Palm Kernels was maintained throughout, and the export for the first six months exceeded that for the corresponding period of 1930 by over 600 tons. During the last six months of the year prices dropped to the lowest point in the history of the industry, with the result that the total export for the year was over 2,000 tons less than in 1930; but there were heavier stocks held in Freetown at the end of the year than usual.

A good standard of Palm Oil was maintained throughout the year; but there was a very considerable decrease in the exports as compared with those of 1930, due entirely to the low prices offered, the decrease being nearly two-thirds by weight.

Every effort was made during the year to improve the quality of Piassava for export, with successful results particularly in the coastal areas of the Southern Province. Efforts were also made to open up new areas in this province in the districts along the railway line. The high price of piassava as compared with that of palm kernels greatly assisted these, and a considerable quantity of prime quality was produced. This price, although less than in 1930, remained more or less steady during the year with the result that there was a steady increase in the trade, and the export for the year under review exceeded that for 1930 by over 700 tons, or nearly one-third. It is interesting to note that in previous years Calabar-Opobo piassava was quoted on the home markets at £10 to £18 per ton more than Sierra Leone prime Sherbro; whereas now the difference is under £4.

Trials of Retting Piassava were carried out at Sulima in brackish tidal swamps with a view to gaining definite information as to what extent the age of the leaf-stalk affected the quality of the fibre, particularly with regard to mature and over-mature leaves; and also for ascertaining the minimum time necessary for retting in this kind of water. The fibre prepared during these trials was submitted to the Imperial Institute for examination and its report was published for general information.

Trials carried out to test the suitability of Steel Shavings, kindly supplied by a firm in Freetown, for the final cleaning of piassava fibre have proved that they are most suitable for cleaning piassava which has not been retted for period sufficiently long to facilitate the removal of pith by the ordinary native methods; so that it is evident that prolonged retting would not be necessary if these shavings were used; but it is doubtful if the native will purchase them. Firms at Sulima and Mano Salija however have placed orders for supplies with a view to encouraging their use.

It was considered that the pith and waste matter extracted in the process of cleaning piassava fibre, and described as Piassava Tow, might be put to some commercial use; and a sample was submitted through the Imperial Institute to a firm of upholstery material importers in London, who reported that the material could possibly be used as a cheap stuffing for upholstery in competition with Algerian fibre and coir, but that the price would probably be too low to make its shipment profitable. Since this report was received a firm of piassava exporters in Sierra Leone has received an order to supply 50 tons of the tow to the Continent.

During the early part of the year special efforts were made to encourage the production of Raffia for export. The price offered to the producers did not however interest them to any great extent, with the result that less than 1 ton was passed for shipment. This was however sufficient to prove that with care it is possible to produce raffia in Sierra Leone equal to Madagascar "Prime Majunga" quality, as it was sold on the Continent at £87 per ton.

The cultivation of Ginger is gradually spreading, and it is noticed that the product from new areas is of a better quality than that from those around Mano and Moyamba where ginger has been produced for close on fifty years. Improved methods of cultivation are gradually being introduced by the department and taken up by farmers; and it is hoped that in the near future a superior quality will be exported from these new areas. The exports were slightly less in quantity than those of 1930.

The number of persons reported by the Inspection Staff for offences against the Native Produce Ordinance was 95, 84 of these being convicted, 8 discharged and 3 remaining to be dealt with.

The Verification of Weights and Measures was carried out by the Inspector and Assistant Inspector, in addition to their ordinary duties, and 104 certificates of justness were issued.

G. TUACH,
Inspector of Plants and Produce.

PART III—AGRICULTURAL INVESTIGATION.

ENTOMOLOGICAL WORK.

The following account of the work is first given under the different crops with which it was done.

No symptoms of mosaic disease of CASSAVA have yet been produced in cases where insects and mites from infected plants have been placed on clean plants. It is proposed for the present to limit experiment to two of the more susceptible varieties of cassava. *Stethorus jejunus*, Casey, is predaceous on the eggs of the mite.

Observation relating to fruit-piercing *Lepidoptera* on CITRUS, has been concentrated on search for immature stages and larval food-plants. No further information has been obtained; although since the larvæ may feed at night, frequent search has been made during this period as well as by day. A collection is being made of likely food-plants, to grow at Njala, and will include as many species as possible of *Menispermaceæ*, *Ebenaceæ*, *Sapotaccæ* and *Combretaceæ*. *Papilio nireus*, L. was noted as a citrus defoliator.

The larva of *Virachola bimaculata*, Hew., was recorded as a local pest of Liberian COFFEE berries, feeding on the developing bean so that one larva may destroy four to six berries in this way. Pupation takes place inside the berry, emergence occurring after a period of eleven days, this being in the month of January. The adult has also been observed in November. *Pseudococcus njalensis*, Laing, is prevalent on coffee of robusta varieties in the base of the inflorescence and among the berries, causing the fall of flowers and berries. It is preyed on by *Scymnus ornatus*, Sicard, *Rodolia occidentalis*, Wse., a *Cecidomyid* (*Triommata coccotroctes*, Barnes), and the larva of an unidentified *Lycænid*, which control it to a great extent.

Experiment with regard to mosaic disease of the GROUND-NUT has been continued, and in the insectary symptoms have been obtained following the introduction of a winged female from an infected to a clean plant. The symptoms, however, were not typical, and this is apparently due to lack of light. Alterations in the insectary are to be effected accordingly.

Since the symptoms vary to a great extent these are being correlated as far as possible with age of infection, age of plant, degree of infection, and time of year, as well as one with another. The disease is often referred to as "rosette," but "rosetting" is by no means a general symptom. For present convenience and purpose of reference, the symptoms have been grouped, according to colouring and form of leaf or plant, as follows: (*a*) leaves etiolated; (*b*) leaves with small patches of normal green, plant not stunted; (*c*) leaves etiolated except for the veins, not stunted, stem sometimes elongated and upright; (*d*) leaves almost normal

green, somewhat dwarfted; (*e*) leaves variegated, with little etiolation, somewhat dwarfted; (*f*) plant rosetted, the majority of leaves being very pale green, curled and stunted. These may, or may not, be all due to the same disease, and observations are being made to decide this. In the case of one plant, two infected leaves with characters according to group (*a*) were formed thirteen days after germination; all succeeding leaves were infected and the symptoms progressed from (*a*) to (*b*) to (*c*), but there was no ultimate "rosetting."

The disease is present on ground-nut throughout the year, but its rate of spread is variable, presumably related to the stage (winged or wingless) and number of the carrier and, possibly, associated insects such as ants.

The insects most prevalent on ground-nut in Sierra Leone, and probably including any that are likely to be carriers are, in order of abundance: *Aphis laburni*, Kalt., leaf-hoppers (three main species, general feeders), *Halticus tibialis*, Reut. (Capsid, general feeder), *Aleurodes* sp., *Thrips*, Mealy bug (? sp.; usually on subterranean parts only). Some are of seasonal occurrence, and some general feeders, whilst others have been observed only on ground-nut.

With reference to transference of the disease, trial has been made with: *Aphis* (winged and wingless adult, nymph), Leaf-hoppers (adult and nymph), Capsid (adult and nymph), Thrips (adult), *Aleurodes* (adult, and nymphs from eggs). No symptoms developed except as previously stated.

With regard to the Aphids, they are usually attended by ants of three species which may play a part in their distribution. A plot was arranged to prevent the passage of ants to and from plants and seeds were sown. On one plant, one winged form only was present four days after germination; two days later there were two such, accompanied by some young; two more days, and symptoms of disease appeared on unopened leaves; while after a further two days the leaves had opened out and assumed the symptoms as given in group (*a*).

It is thought that the distribution and relative amount of starch in the leaf tissues may form a convenient index for degree of infection, and work on these lines is in progress.

Larvæ of the Syrphids, *Paragus borbonicus*, Mcq., *Ischiodon ægyptium*, Wd., and *Paragus longiventris*, Lw., as well as the Coccinellid *Scymnus scapulifrons*, Muls., predaceous on *Aphis laburni*, Kalt., were very numerous. In addition, a disease killed many of the aphis. Defoliators included *Prodenia litura*, F. and *Lamprosema indicata*, F.

The invasion of Migratory Locusts, *Locusta migratoria*, was on a greater scale than that of the previous year; and during January 59 reports of swarms were received, in February, 64; in

March, 55; in April, 36; in May, 7. No swarms were reported in November and December. Owing to the hilly nature of the country, as well as to the number of rivers, a local observation of direction of flight cannot be taken as the general direction, and from the records received it was impossible to correlate them.

Specimens from swarms were collected for dissection, and mature eggs were found in the ovaries from February 4 onward. Eggs deposited in the laboratory on February 16 hatched on March 2, and after five moults fliers were produced on March 31; these were of the typical swarming phase. Specimens bred in May and June were of the same phase. It may be mentioned here that eggs deposited in the laboratory towards the end of September, 1930, hatched near mid-October. The incubation period was nineteen days. Only two individuals were successfully reared, one of each sex, and they proved to be of the solitary phase. The time between hatching and emergence of imago was fifty days for the male and fifty-eight for the female.

The first report of hoppers was received on May 2. A general account of the campaign against these is given in the report of work in the North-western and Northern Circles.

On March 23, a swarm of Desert Locusts (*Schistocerca gregaria*) was reported from Kabala but no further record was received. It is notable, however, that after the passing of a swarm of *Locusta migratoria* at Njala on March 26, eight specimens of this locust were collected from the ground.

Among Miscellaneous Pests were included a *Coreid* which attacks the young rice grains; *Phytometra chalcites*, Esp. on cacao; *P. acuta*, Wlk. on banana and tobacco; *Prodenia litura*, F. on tobacco and *Hippeastrum equestre*, in the last case living in the flower stem and eating the flowers: *Heliothis armigera*, Hbn. on tomato fruit, also boring in the stem; *Dacus punctatifrons*, Kars. on fruits of tomato and cucumber; D. *bivitatus*, Big. on fruits of pawpaw and cucumber.

The Reference Collection was extended by over 1,000 specimens submitted to the Imperial Institute of Entomology. Identifications received included twenty new species and forty-two new to the British Museum.

E. HARGREAVES,
Entomologist.

MYCOLOGICAL WORK.

The following account of the work is first given under the different crops and plants with which it was done.

Plants of Guinea-corn in the nursery at Njala showed elongated somewhat irregular brown leaf-spots, paler when older. Affected leaves when placed in a moist chamber produced numerous

pycnidia but no spores. It is probable that the causative fungus is a *Phyllosticta*, and this may be the cause of similar spots on this plant seen commonly in the Northern Province.

One or two cases of fruit-rot of Banana were encountered during the year, but this does not appear to be common yet in Sierra Leone. If large plantations of bananas are made, however, it may be expected to become more serious as conditions in the country appear to be favourable for the growth of certain fruit-rotting fungi. *Cercospora musarum* was the fungus associated with the single case of black tip-rot of Canary bananas found at Newton. *Glæosporium* seemed to be responsible for a black tip-rot of Canary bananas at Njala.

Canary bananas at Newton and elsewhere have been affected by a spotting which is common in the wet season, called fruit-spot. The spots, which are especially numerous on the upper side of the fruit as it hangs on the plant, make their appearance on the half-ripe fruit as small circular water-soaked areas each with a minute brown spot in its centre. The water-soaked area increases up to 1–2 mm. in diameter while the central spot is still small. Later, this spot increases in size and darkens, becoming sunken, and eventually a dark sunken area about 1 mm. in diameter is formed, with a narrow water-soaked margin. Several dark areas may unite to form fairly extensive black areas which spoil the appearance of the fruit. With the natural increase in circumference of the fruit in maturing, the spots if small are drawn out into short transverse streaks. Cracks appear if the large black areas have become well-formed before full expansion of the fruit has taken place, the cracks being greyish at their margins and extending in a longitudinal direction.

Slices of the epidermis of young spots showed that the brown spots begin in many if not all cases under the stomata. The stomatal guard-cells are sometimes browned. In older spots the cells below the epidermis are brown and their contents somewhat shrunken. No fungus except *Pestalozzia* was seen on the spots. The leaves of the banana plant were never attacked. Spotting of the fruit appeared to be more abundant on bunches which were not shaded by the leaves. On well-shaded bunches it was usually absent.

Specimens of die-back of Cacao, stated to be most prevalent in places which are likely to be water-logged during the rains, were received from the Northern Province. *Diplodia* was associated with the damage.

Two apparently distinct types of *Glæsporium* attack were recorded on Cassava. The die-back disease at Makump (Annual Report, 1930, p. 30) affected nearly all the plants on a one-acre plot of Mayugbe, and at least 20 per cent. of defoliation occurred in 1931, a few being completely defoliated. Only the young shoots, usually 9–12 inches but in a few cases up to 18 inches from the tip,

were attacked. At Njala, on some plants of Kande and Sessile-leaf cassava, grey lesions appeared around the base of some of the upper leaves and extended along the main stem below the node to a distance of half-an-inch. In later stages the lesions extended above the node as well, and affected leaves wilted and died; whilst in a few cases wilting of the tip of the shoot occurred.

Mosaic disease has been seen or reported on nearly all varieties of cassava, but data so far available show that its spread is very slow and that there is varietal difference in susceptibility. One of a small number of plants of Mende-lange (a widely-grown sweet variety) planted in July, 1928, with leaves in contact with mosaiced cassava plants, become diseased in October that year; but none of the other plants showed signs of the disease by May next year. About twenty healthy plants of Mende-lange were planted in May, 1929, in beds adjacent to a bed of mosaiced plants of the same variety. Two of the originally healthy plants became diseased in November of that year. The plants have been left in the ground ever since, and by the end of 1931 about a third of the originally healthy plants were mosaiced, one plant having become infected late in 1931. Of some plants only one-half of the stems show symptoms of the disease although they have been mosaiced for one or two years. The disease has not spread to cassava plants in a native garden 100 yards away.

In both these experiments a number of plants of Mayugbe (a much-liked short-season, sweet variety of comparatively recent introduction) were planted among the Mende-lange plants. In no case has a Mayugbe plant become mosaiced. On the sandy soil of Bonthe Island, however, where more than 50 per cent. of the cassava plants are mosaiced, Mayugbe was seen with the disease (*see* Report of Western Circle).

Trials of inoculation were made on healthy cassava plants of over fifteen varieties at the end of 1931, a narrow strip of the tissues down to the wood of the healthy plant being replaced by tissues from the internode of a mosaiced plant. Out of thirteen plants so treated in November, three produced in December mosaiced shoots originating just below the graft. Further attempts to inoculate are being made.

Careful investigation at Newton and Njala have failed to detect the presence of canker of Citrus. Scab is however common and at present the most important disease of citrus in Sierra Leone.

Observations have been continued on the incidence of scab on the leaves of the young citrus trees (planted in 1927) at Njala. These show that infection is only very slight at the time of the first (main) leaf-flush which occurs in March. New leaves were produced in small quantity right up to the middle of the dry season, and there is a fair flush about August. Scab becomes more abundant on the young leaves during the rainy season; after this

there is some decrease during November and December. New leaves produced in January during the harmattan become scabbed in many cases, though not severely; and evidently conditions are not altogether unfavourable for infection at this time although the temperature rises over 90°F. during the day and relative humidity drops at 20–40 per cent. For about ten hours of each night however, even in this dry season, the humidity is well over 80 per cent. and the temperature is between 70 and just over 60. Fruit formed from flowers which opened during the rainy months were badly scabbed. Spraying during the months when scab infection is most severe is hardly economic on a plantation in Sierra Leone, as the number of wet days in June to September inclusive is at least 25 per month and rain may fall every day.

The following is the order of susceptibility to scab of leaves of the different kinds of citrus in the nursery at Newton as determined this year: badly scabbed, rough lemon; rather badly scabbed, grapefruit; moderate scab, Tahiti lime, sour orange and Genoa lemon; slight scab, tangerine; no scab, sweet orange, shaddock, lime and sweet lime.

The fungus forming felt-like patches on the leaves of grapefruit and lemon has been identified as a species of *Septobasidium*. It has not yet been seen on the twigs.

Cephaleuros was the cause of canker-like lesions more or less completely girdling the stems of a plant of Liberian Coffee at Makump.

A *Cercospora* was associated with a small irregular dark-grey leaf-spot on seedlings of Dodonea (*D. viscosa*) at Njala. It was controlled by reducing the shade over the plants.

A rosette disease of the Periwinkle (*Lochnera rosea*) was seen on one or two plants at Njala. The leaves remain green but are slightly smaller than in normal plants and the internodes are shortened, so that when the older leaves fall off in the normal way the remaining leaves are bunched together in rosettes at the ends of the bunches. Much branching of the stems about 4 or 6 inches from the ground occurs so that attacked plants are bushy; these do not flower. The disease spread to neighbouring plants. Seedlings coming up near an affected plant were healthy and the disease would appear to belong to the virus class. No fungus could be detected in diseased plants.

A *Cercospora* leaf-spot was found on Sesamum (*S. radiatum* and *S. indicum*). A chlorosis of the former is common. The infection of the plant apparently takes place some time after it has passed the seedling stage, the lower leaves of an attacked plant being generally normal and green. Slightly affected leaves are mottled, the portion along the veins being yellow with the intervening parts of the leaf a normal dark-green. In badly diseased

shoots the leaves are yellow, a yellow-green colour being visible over the portions of the leaf-tissue between the veins. Such leaves are often curled, their edges being generally turned upwards, and they are smaller than normal. In some cases a leaf may be mottled over one-half and chlorosed over the other, the dividing line being the midrib. On badly chlorosed leaves, enations, generally over the net-veins but often over the primary branch veins or even over the midrib itself, have been observed on the lower surface. These often take the form of minute foliar structures, sometimes about 5 mm. in diameter. Diseased plants appear to be somewhat stunted, and flowering is entirely inhibited. The disease seems to belong to the virus class. *S. radiatum* is commonly cultivated by natives, who eat the leaves; but chlorosed leaves are said not to be eaten. No extensive damage is done as the disease appears to attack the plants after all the leaves required have been taken, and the reduction in the fruiting is of no significance as seeds are only needed for propagation. It has not been seen on benniseed (*S. indicum*), but a somewhat doubtful record was made on *Ceratotheca sesamoides*.

A mosaic disease, probably of the virus class is common on Sida (*S. urens*). The affected leaves are yellow along all the veins, but except in badly diseased specimens are dark-green between the veins. In such leaves the chlorosis is more general although the portion of the leaf between the veins is always greenish.

The fungus responsible for " scurf " on the tuberous roots of Sweet Potato has been identified as *Monilochaetes infuscans* (Ell & Halst) Harter. A pale green leaf-spot more or less circular and 2–3 mm. across, with a narrow brown zone at the edge and bounded by a narrow raised dark line, was found on sweet potato growing round the only fishing hut on Boltum, Turtle Islands. On the upper surface numerous dark pycnidia are formed of *Phyllosticta*, probably *P. batatas*. This leaf-spot has not so far been seen elsewhere.

A mottled chlorosis of Waltheria (*W. lanceolata*) is common, and may be due to a virus. Irregular chlorotic areas appear on the leaves, bearing no particular relation to the positions of the net-veins, though the areas are limited to the larger veins. In leaves in which large chlorotic areas occur, the area along the net-veins in the green portions of the leaf may be yellow. Similar symptoms occur on *Sida carpinifolia*.

In regard to Miscellaneous Plants, strains of *Rhizoctonia solani* with small sclerotia have been recorded on *Phaseolus aconitifolius*, maize, pigeon pea, broad beans (*Vicia*) *Spigelia Anthelmia*, *Lochnera rosea*, *Dolichos biflorus* and *Crotalaria juncea*, besides other host plants previously recorded. A strain with large sclerotia was recorded on maize (evidently the disease described in *Year Book, Dept. of Agric.* Ceylon, 1927, p. 44) and on pigeon pea. *Sclerotium rolfsii* was recorded on *Tigridia*,

Zephyranthes, Commelina tuberosa, Zinnia, Xanthosoma, maize and the red-leafed ornamental *Alternanthera,* besides other host plants previously recorded. This fungus also causes a leaf-spot of *Luffa cylindrica,* very similar to the leaf-spot it causes on Chinese yams.

The following identifications have been received from the Imperial Mycological Institute: *Cercospora stizolobii* Sydow, on Bengal bean (*Mucuna pruriens*); *Cercospora melongenæ* Welles, on eggplant (*Solanum Melongena*); *Cercospora duddiæ* Welles, on onion and native shallot; *Cercospora canescens* E. & M., on cowpea (*Vigna*) and French bean (*Phaseolus*); *Cercospora amorphophalli* Henn., on *Amorphophallus* sp.; *Cercospora sorghi* Ell. & Ev., on native guinea-corn (*Sorghum margaritiferum*); *Cercospora cucurbitæ* Ell. & Ev., on cucumber; *Cercospora* sp. n., on *Scytopetalum Tieghemii*; *Cercospora* sp. n., on a sagittate-leaved aroid; *Scolecotrichum musæ* Zimmerm., on banana leaf-spot: *Myriogenospora paspali* Atk., on *paspalum scorbiculatum*; *Hemileia scholzii* syd., on *Clerodendron scandens*; *Uromyces illotus* Arth. & Holw., on *Mucuna urens*; *Uromyces leptodermus* Syd., heavily parasitised by *Darluca filum,* on *Brachiaria distichophylla*; *Aschersonia hypocroidea* (Cke. & Mass.) Petch, on *Aleurodes* sp. on *Funtumia africana, F. elastica* and *Anisophyllea laurina*; *Xylaria plebeja* Ces., saprophytic on a dead stump; *Clasterosporium maydicum* Sacc., *Leptosphæria patellæformis* Passer, *Gibberella saubinatti* (Mont.) Sacc., *Acrothecium lunatum* Wakker, *Cercospora sorghi* Ell. & Ev., and *Ophiobolus heterostrophus* Drechsl. (conidial), on dead male inflorescence of maize; *Ophiobolus heterostrophus* Drechsl. (conidial), *Phoma insidiosa* Tassi, and *Acrothecium lunatum* Wakker, on maize husks; *Clasterosporium maydicum* Sacc., *Phoma insidiosa* Tassi, *Acrothecium lunatum* Wakker and *Cercospora sorghi* Ell. & Ev., on a mouldy inflorescence of *Sorghum guineense.*

The Herbarium has been kept as in past years by the Mycologist. Over 500 specimens were added during the year, including collections by Mr. R. R. Glanville, Mr. J. W. D. Fisher and Mr. G. M. Roddan, including many cultivated and ornamental plants. Duplicates of these have been sent to Kew.

F. C. DEIGHTON,
Mycologist.

NJALA AGRICULTURAL STATION.

For the first ten months this was in charge of Mr. E. I. Nisbett and in that of Mr. G. M. Roddan for the remainder.

Among Perrennial Crops, the Deli Oil-palms planted in 1930 (which will come under Njala Oil-palm Plots when they are yielding) have made very good progress.

In the CITRUS plantation the late Valencia and Washington Navel oranges, obtained from South Africa and planted in 1926, bore a good crop this year; but the quality of the fruit was very unsatisfactory, although it improved to some extent as the season advanced. Of the grapefruit obtained from Florida and planted in 1927 and 1928 only the Foster and one tree of Marsh Seedless are yet bearing. The Thompson and the remainder of the Marsh, and the McCarty obtained from the same source and planted in 1929, have not yet shown sign of fruiting. The Genoa lemons, also from Florida and planted in 1927 are bearing; and there is a good crop on some trees. Satsuma and St. Michael oranges obtained from England and Villa Franca lemons planted in 1928, have not yet begun fruiting. The outturn of the old grapefruit trees in the Arboretum was much less than in 1930, when there was an exceptional crop.

Scab was present on both lemons and grapefruit, and damage has also been done to oranges and grapefruit by fruit-piercing moths, matters which are receiving the attention of the Mycologist and Entomologist.

Budwood of grapefruit and Genoa lemon has been sent to Newton Experimental Fruit Farm throughout the year.

Pigeon Pea and Tephrosia were sown in May between the citrus trees to supply mulch material and Pigeon Pea has done well, giving one cutting in October while the Tephrosia failed to germinate.

The yield of Dominica limes is declining; but the influence of the thinning in 1927 in increasing the yield is still very marked. The original spacing at planting in 1916 was 15 × 15 feet; at the thinning every alternate tree was cut out on one-half of each section. No manures have been applied since 1929. The following table gives the yield in bushels per 100 trees from each section during the past four years: A thinned sections; B unthinned:—

	A	B	A	B	A	B
1928	633	763	370	474	455	431
1929	681	512	465	327	389	247
1930	532	392	492	259	257	186
1931	348	153	205	72	159	52

The Canephora and Robusta COFFEE plantations received no attention except brushing and mulching. The December, 1930 to February, 1931 crop was small; the last was much better but both are much below the two previous. All the crop from these plantations is distributed as seed through the Circle officers.

The Stenophylla coffee has been maintained only as a source of seed. A quantity has been sent to the Newton station for raising plants for distribution in the Colony. All the Liberian has been cut out except twelve well-isolated trees. Seed of Excelsa coffee obtained from Porto Rico failed; but a further supply germinated satisfactorily.

A trial was begun in the KOLA plantation to find the effect on the yield of "spiralling" and root-pruning the trees. Root-pruning was done by cutting a trench round the tree just within the spread of the branches and of a sufficient depth to expose all spreading roots which were then severed. Spiralling was done by cutting out a strip of bark about an inch wide in a spiral being from just above ground level to the main fork, the turns of the spiral being about a foot apart, and ensuring that the spiral completely encircled the tree; both were carried out in May, the main harvest season being December–January. Observations made at the end of November before the pods were ripe gave the undermentioned results, though it is too early to take these as conclusive; the increase or decrease being that over or under the average yield per tree through the preceding five years:—

—	Number.	Increase.	Decrease.
Spiralled	12	60	—
Root-pruned	12	1	—
Untreated	89	none	none

The SISAL is maintained as an economical source of cordage. Planted in 1924, cutting began in 1927; poling started during the year. The plot has never been cropped to capacity.

The HYDNOCARPUS trees (*Hydnocarpus anthelmintica*) which were raised from seed obtained from Malaya and planted out in 1928 in lanes cut in standing bush and cutlassed periodically are making progress.

Thinning out has been done in the ARBORETUM and preparation made for further extension. Specimen groups of *Aleurites montana*, *Butyrospermum Parkii* and *Melicocca bijuga* have been planted out. Interesting trees have been raised from seed obtained during the year, some of which will be planted out during 1932.

With reference to ANNUAL CROPS, the trials with native varieties of SWAMP RICE begun in 1930 were continued, and also a number of varieties collected by Mr. R. R. Glanville in India and Ceylon were grown; observations were made on these latter but their cultivation aimed mainly at the production of seed for trials in 1932.

The native varieties were sown in nurseries the first week of June, and those from Ceylon and India as received, the former in the last week of June and the latter in the second week of July. The notes given below on these rice trials were prepared by Mr. G. M. Roddan.

Variety.	Duration in days.	Average number of tillers.	Height ft.	Colour of grain.	Remarks.
Pa D. C. (i)	152	1·5	3	White	A failure
Pa Kalamodu	215	3	4	Red	Not satisfactory--rust disease
Indo China (i)	205	1·3	5	Red	Unsuitable plot
Pa Yaka	196	2	3½	Red	Tillered poorly but uniform stand
Indo China (ii)	214	1·4	6	White	Failed
Pa Yenti	154	3	5	White	Yield fair
Pa Fodea	198	3	4¼	White	Poor variety (mixed sample)
Pa Litoma (ii)	185	5	4½	Red and White	Good stiff straw—uniform
Jabati	186	3	3½	Red and White	Good yielding rice—uniform
Pa Yoso	144	3	4	White	Moderate rice of short duration
Pa Kanlokafol	207	9	4¼	White	Uneven but fair yield
Pa Indian	186	5	4½	Red	Rust disease—fair yield
Pa Bolo	188	3	3¼	Red	Very moderate
Pa Mampa	196	6	4	White	Good tillering ; yield moderate
Pa Lal	205	5	4	Red and White	Good average rice mixed
Pa Kanlu	184	4	4	Red	Very mixed sample
Pa Kunko	144	2	3½	Red	Very poor
Black Yakei	188	8	4¼	Red	Grew well but finished poorly
Pa D. C. (ii)	144	3	3	White	Did not thrive well—water insufficient
Pa Kima	205	2	2	Red	Largely destroyed by deep current
Pa Totoko	144	4	4	White	Grew well and yield also good

Native Rices—continued.

Variety.	Duration in days.	Average number of tillers.	Height ft.	Colour of grain.	Remarks.
Pa Alie Kamara ...	175	6	3	White	Sturdy rice—yield good but quality poor
Pa Alibig	196	4	4½	Red	Did well—large grained
Pa Litoma (iii)	179	4	3½	Red	Yield moderate but quality good
Pa Kanlu	184	3	3	Red and White	Mixed sample
Hinati	127	1·1	4	Red	Dried off—very unsatisfactory
Pa Bis	208	13	3½		Prolific tillering—growth even—yield good
Pa Lat	188	3	2½	Red	Poor variety
Pa Koba	185	5	4	White	Questionable variety but good
Pa Sanuuya	—	4	5	White	Late ; did not mature
Gbongo Yakei ...	202	6	4	Red	Good average rice—rather mixed
Bowden's Kono	202	6	4	...	Moderate variety

Variety.	Duration in days.	Average number of tillers.	Height ft.	Colour of grain.	Remarks.
Baitel Fakir	168	13	6	Red	Quick growing; profuse tillering; rounded stem internodes long (about 12 inches) Brown hairs on ligule. Ears are indistinguishable from the native Black Yakei. Gave excellent yield of good quality grains. Very promising rice.
A. D. T. 1	210	11	3	White	Was very good to begin with but being a long period rice the drying of the swamp seriously affected the finish, and little good seed was harvested
Panianala	180	16	$4\frac{3}{4}$	Red	Internodes long; leaves narrow; ligule hairy; grains short, plump and white. Did much better in deep water; very promising
A. D. T. 5	215	11	—	White	Slow growing, and finished poorly owing to drying of the swamp; an unsatisfactory trial
Harisankar	210	5	$5\frac{1}{2}$	White	Strong growing; long internodes, grains medium sized and white; requires deep water; finished poorly

Indian Rices—continued.

Variety.	Duration in days.	Average number of tillers.	Height ft.	Colour of grain.	Remarks.
C. O. 7	180	10	5	White	Round stem ; long internodes ; white hairs on ligule ; did not do well in deep water but in medium depth it was good
Jeeraga Samba	137	5	5	White	Very quick growing ; fine, weak straw ; pendulous open heads—small grains, very white ; did well and seems suited to shallow flooding
G. E. B. 24	151	10	5	White	Quick growing ; tillers well ; fine straw, very open panicle—grains small ; gave an excellent yield ; will probably suit medium flooded areas
C. O. 5	180	10	6	White	Did not suit the deep water of the plot ; stem rounded and fine ; ligule hairy ; leaves narrow ; medium sized grain ; yielded very well

Variety.	Duration in days.	Average number of tillers.	Height ft.	Colour of grain,	Remarks.
Hetadawi	127	1	$2\frac{1}{2}$	Red	Almost a failure; yielded about the same amount of seed as was sown
Kandimurangan ...	127	1	2	Red	Failure; small amount of seed reaped
Sudubeenati	154	1	3	Red	Failure; small amount of seed harvested
Sudumawi	-	—	—	—	Failed to germinate
Kurulutuduwi	—	—	—	—	Failed to germinate
Vallai Illankalyan ...	147	8	5	Red	Quick, strong growing rice; stem flattened; internodes short; ligule very hairy; very broad leaves; did best in deep water

Three varieties of Nigerian Yams, Esuru white, Esuru yellow and Akpane were again grown, but do not appear to possess any advantage over existing native food crops and are not generally popular in this country on account of their requiring several hours' cooking; just over an acre of Chinese yams were grown for distribution as "seed." They are very popular and their cultivation is rapidly spreading.

Calopogonium (*C. mucunoides*) and Bengal Bean, having established themselves on those plots where sown in 1930, have both formed a good cover and supply ample material for turning in; they are also to some extent effective in smothering lalang. The former is very satisfactory as a cover in the Arboretum where it comes up year after year and provides a good deposit of organic matter.

Pigeon Pea has grown well as a supply of seed and for the purpose already mentioned. *Tephrosia* (*T. candida*) has not so far been successful. Bonavist Bean has failed so far; whilst Pueraria (*P. thunbergiana*) shown promise of being an effective cover and smother crop when established.

Cowpea, *Dolichos biflorus*, *Crotalaria juncea*, *Tephrosia biflorus* and varieties of *Phaseolus* are also under observation as cover crops on a small scale.

Work was carried out with Sunn Hemp (*Crotalaria juncea*), with the object of finding out its suitability as a fibre-producing crop in Sierra Leone, seed being obtained from Nyasaland and Rhodesia. Trial was made with it both as a wet-season and a dry-season crop and on alluvial and laterite soils. For the wet-season trial sowing was done on May 18 and a portion was cut from that on laterite soil in the middle of September, just as the corollas were falling. On the laterite soil the crop appeared quite satisfactory making stems of 4 and 5 feet and over but on the alluvial soil it was worthless. The dry-season crop was sown on September 18 and harvested on December 18 and appeared as if it might have been better than the first but seems to have sown rather too thickly. Samples of the fibre from both crops were sent to the Imperial Institute for report, and they stated that the fibre was on the whole good but required better preparation.

Seed of Millets, mainly pure-line selections, also collected by Mr. Glanville in India, were grown. These were sown when received on July 31, though where quantity of seed permitted a second sowing was made on September 30. Production of seed for trial during 1932 when time of sowing could be chosen, was the main object aimed at. The notes given below were prepared by Mr. Roddan.

Variety.	Duration in Days.	Results.
Andropogum Sorghum (1)	—	Failed
Andropogum Sorghum (2)	—	Failed
Eleusine Coracana E.C.593	99	The second sowing in the end of September did best and the results merit another trial
Setara italica 226 ...	—	No germination
Setaria italica 907 ...	—	Failed
Panicum miliaceum ...	—	Germinated but died
Panicum miliare ...	70	Sowings on 31st July and 30th September were very similar. Both quite good and worth a further trial
Eleusine Coracana ...	75	Unsatisfatory trial ; seed available
Pennisietum typhoideum	—	Failed to germinate
Setaria italica (*sen tenai*)	68	Poor ; seed available
Setaria italica (*sen tenai*)	70	Very poor
Eleusine 620	80	The second sowing in the end of September did best. Easily the best of the millets and a very promising crop
Eleusine 250	—	Germinated well but became diseased and did not finish to permit harvesting
Eleusine 47	—	No germination

In addition to those already mentioned the following seeds were obtained from Departments of Agriculture in India and Ceylon by Mr. Glanville and were given trial. The notes appended were prepared by Mr. Roddan.

Variety.	Remarks.
Dolichos biflorus	Did well until attached by Rhizoctonia. Finished well and gave a good supply of seed.
Cowpea (*long pod*) ...	Grew well and gave a good yield of seed
Phaseolus lunatus ...	No germination
Phaseolus Mungo ...	Gave a very satisfactory yield. The beans are small
Phaseolus aconitifolium ...	Did poorly till the start of the dries when it improved greatly. Worth a trial under more favourable conditions
Jaffna King Yams ...	Growing well under unsuitable conditions
Gliricidia maculata ...	Growing well
Crotalaria juncea ...	Satisfactory
Pipernigrum ...	No germination
Leucæcna glauca ...	Growing well
Tephrosia purpurea ...	Poor

A new activity was DISTRICT WORK, begun in July in five chiefdoms—Kori, Kamagai, Maje, Kowa and Dase, served directly from the station. Farmers have already made thirty new plantations of coffee in these, and a significant increase is expected in the next and following years. Small plantations of Nigerian oil-palm were also made in Kowa and Kori Chiefdoms.

E. I. NISBETT,
Agricultural Officer.

NJALA OIL-PALM PLOTS.

Cultural operations were confined as before to cutlassing the grass and removing old leaves to heaps between the rows. Ring-weeding was continued, primarily for the convenience of recording.

The NIGERIAN PALMS are in their eleventh year after planting. Their kinds and numbers as so far determined are: Thick-shelled (B) 159, Thin-shelled (A) 143 (exclusive of Togbui), Medium-shelled (C) 15, Mantled (D) 1, Togbui (pisifera) 6, undetermined, 10. Three new trees came into bearing for the first time in 1931, namely 2/5 (B) in April, 10/1 (B) in September and 7/11 (Togbui) in November.

Opportunity was found this year to preserve specimens of fruit and to record colour-difference for all A and C palms. It is already known that several distinct types are included in these, and a more complete classification of them will be made in the near future, although for convenience of general comparison yields will still be recorded under the old groupings. The B type of fruit can be considered as constant in character, though some seasonal variation in size and degree of rotundity occurs on individual trees. The individual trees of the A and C groups throughout the last two years have given fruit constant in character except that there is again some seasonal variation in size.

Four trees of the A and three of the B group did not bear fruit in 1931, namely A *2/12*, *7/7*, *9/13* and 21/2; and B 5/11, *9/2* and 24/11, italics indicating non-bearers in either 1930 or 1931. In addition, 2/12, 9/13 and 21/2 did not bear fruit in 1929. The B 5/11 and 24/11 are the only trees of the above seven which have borne fruit at all reasonably well, the former giving an average yield in 1930; but the individual yield of each of the seven trees for the six years 1926–31 has been well below average.

The figures for the YIELD of the different groups, the yield of the whole plantation, and of averages, etc., are given in Appendix IV. The production for the first five months of the year was less than for the corresponding months of 1930, but subsequently it was so much greater than in corresponding months of 1930 that the total output of fruit for 1931 was 4,467 lb. more than for 1930, and 3,432 lb. more than for 1928 which was the

best year previously. The number of fruit-bearing heads was twenty-five less than in 1930 and there was also a decrease of sixty-six in the number of " blind " (or abortive) heads harvested. The increase in yield was shown more or less equally by both A and B groups, but in proportion the yield of the C showed a greater increase than either the A or the B.

Although manuring would probably have increased yields from the plot, the high yield this year is not compatible with any idea that the soil has been " worked out." The decreased yields during 1929 and 1930 seem to be better explained by assuming that the " resting " phase which has been periodically apparent in individual trees affected in these years a large proportion of trees in the plot. During 1929 and 1930 there were still individual trees giving yields as high as the highest recorded in 1928. As in previous years the proportion of fruit per head for the thin-shelled was regularly less than for the thick-shelled, that of the former being above 60 per cent. in one month only (November), while that of the latter was only in one month (June) below 60 per cent.

In regard to Flowering, the number of female inflorescences at anthesis recorded during the year was 650 more than in 1930. It increased as usual to a maximum in the second half of the year and there was also a large number of flowers in the first half. In no year has the female flowering curve shown a rise to a peak in the spring months comparable with the marked peak which has always shown in September or October; and this spring production of flowers has varied in amount in different years, as shown by the figures for number of female inflorescences at anthesis from January to June inclusive, namely 1927, 1,141 (excluding January); 1928, 1,248; 1929, 651; 1930, 341; 1931, 859. The steady decline in these numbers up to 1930 gave the impression published in the last report, that the " spring cycle " was in the process of suppression such as has been reported by Mason and Lewin (*Ann. App. Biol.*, XII, 1925) as occurring in older trees. The increase in 1931 does not support this; but the trees mentioned by those investigators as showing such suppression were much older than these palms.

The number of male inflorescences produced in each year has gradually increased as follows: 1928, 1,121; 1929, 2,361; 1930, 3,465; 1931, 4,409. From the time these records were begun, only in 1928 were there fewer male inflorescences at anthesis than female. As in 1930 the number this year was more than twice the number of female inflorescences.

During the last three years the number of male inflorescences in flower has increased rather suddenly from a minimum about June and July to a maximum about October–November (1930 and 1931) or December (1929), after which there has been a gradual diminution to the middle of the next year. There appears to be only one cycle of production of male inflorescences each year.

In 1931, only in one month (June) were there fewer male than female inflorescences in flower. June has always shown such a ratio, and in June, 1928, there was only one male inflorescence in flower per twenty-eight trees. Considering that there are about 20 wet days in June, it seems remarkable that fertilization should be as complete as in other months. Yet the largest heads are harvested about November, and in these heads the proportion of fruit is higher than in most other months and is almost at its maximum. The smallest heads, with the smallest proportion of fruit in them, fruit in the middle of the year; these inflorescences have been fertilized in the dry season, when the ratio of male to female inflorescences flowering is at maximum. It must therefore be concluded that under natural conditions there is always sufficient pollen available throughout the year, and that if fertilization is incomplete at any time it is due to other factors than lack of pollen. Weight of head and of fruit in head are probably determined chiefly by the size and condition of the female inflorescence initiated, which may well vary seasonally. How long, before flowering however, the size of the female inflorescence is determined is not known.

The Average Weight of Fruit Per Head for thick-shelled was $3\frac{1}{4}$ lb. more than for thin-shelled, the actual figures being 11·8 and 8·6 lb., respectively: the average weight of head was about 18 lb. and 15 lb., respectively. The average of B palms was nearly one-an-a-half times that of A.

As in previous years there was a larger proportion of high yielding trees in the thick-shelled than in the thin-shelled group (highest yielding B palm gives 163 lb. of fruit as against 143 lb. for the highest yielding A). As regards total yield of fruit for individual trees for the six years 1926–1931, the highest yielding A tree has given 398 lb. of fruit, while the highest-yielding B tree has given 605 lb. The highest-yielding trees to date are the same as those noted as such at the end of 1930.

It has been found impossible yet to draw up a classification based on character of fruit for Native Oil-palms, as fruit from many trees is still small and mainly kernel. All trees of the Kawei plot are bearing thick-shelled fruit with the exception of two or three with thin-shelled. Most of the fruit from the Henoi plot is thick-shelled, but some trees exist which bear definitely thin-shelled fruit, and one tree has constantly given shell-less (Togbui) fruit. Most of the fruit from the Kpolei plot is thick-shelled, but there are one or two trees giving definitely thin-shelled and one tree which bears thin-shelled mantled fruit. Four of the Angola Palms bear thin-shelled and two bear thick-shelled fruit.

The figures for the Yield, etc., of the different plots are given in Appendix IV. It will be seen that the Periodicity in fruiting and flowering is similar in the native oil-palm plots to that in the

Nigerian. As regards YIELD, the Angola palms are by far the best, that for 1931, in their fifth year after planting, being equivalent to the yield of the Nigerian palms in their seventh.

The yield of Kawei in their seventh year was equivalent to that of Nigerian in their sixth; the yield of Henoi in their seventh, and of Kpolei in their sixth was only about three-quarters of that of the Nigerian in their sixth year. The soil and positions of the different plots are different: Kawei were planted on probably the best soil, fresh bush land near the river, but are liable to flooding during the rains; Henoi are on what is probably the worst soil—old farm-land or alluvial soil covered with lalang grass which was dug out in 1927; the Kpolei were planted next to the Nigerian plot on land which had been one year in cultivation; the Angola in what may about be regarded as a lawn. With only six trees, the last-mentioned cannot be regarded as a "plot" comparable for purpose of averages of yield, etc., with the others. It is of interest that Crown Disease affected nearly all the Kawei and Henoi palms, which have however recovered completely in most cases.

It will be noted that the number of male inflorescences flowering during the year was greater than the number of female inflorescences, in the Kpolei and Kawei plots, but less in the Henoi and Angola palms.

F. C. DEIGHTON,
Mycologist.

NEWTON EXPERIMENTAL FRUIT FARM.

The Manager, Mr. M. Vardy, was in charge from January 31 to December 21. The newly-appointed Agricultural Officer with special training in citrus, Mr. E. S. Garner, arrived on December 17.

As it was found that the WATER SUPPLY was barely adequate for irrigating the nursery and two banana irrigation plots, and for domestic requirements, the scheme for experimentation had to be drastically revised, the chief changes being the abandonment of the old banana plots and the citrus irrigation area.

For the CITRUS, budding, untying buds, staking, tying bud-shoots to stakes, removing side-shoots, heading mack and weeding were in constant progress. The nursery was irrigated from January until the early part of April and a start was also made with this during the latter part of December. Eleven beds of sour orange, 5 of rough lemon, 3 of sweet lemon, 3 of shaddock and 2 of tangerine were planted: and most of these were large enough to be put out at the end of the year. Thirty-five plants of McCarty grapefruit which had been received from Florida in July, 1929, gave 26 survivors by November 1, 1931, those lost being replaced

by plants of the same kind grown on the farm. The remainder have made strong vegetative growth and bud-wood has been taken from them for use in the nursery. Twenty-four plants of Duncan grapefruit were received from Florida in July, 1930; none of them appear to have made good progress, but only two have died. Both these and the McCarty were manured in October. The forty-three acres Grapefruit Rootstock, Variety and Manurial Trials, which by the end of 1930 had been stumped, lined out, mulched at stations, ploughed and ridged across the slopes and planted with *Tephrosia candida*, were picketed again and the belts of this plant made between the rows.

In accordance with a scheme for extending the use of Newton for Plant Distribution in the Colony, seeds for 10,000 seedlings of Dominica lime and 30,000 of stenophylla coffee were sown. By the end of the year a good stand of seedlings had been obtained.

Among Insect Pests termites have been prevented from affecting the above-ground parts of the plants by regularly tapping off the soil tunnels during the early morning when these are wet and the soil falls off easily. It was noticed that attacks from termites were less during the rainy season, and also in the irrigated portions before these became dry. 6,200 crickets were dug up by hand and destroyed during 1931, as compared with over 27,000 during 1930; and in December of the first-mentioned year none were found. It would seem that this method of control is proving effective.

Of Diseases of citrus, scab was first noticed on Marsh grapefruit on July 17. The infection was general during August and September; but during October, following the removal of diseased growth and spraying with lime-sulphur solution, the infection had apparently diminished considerably. By December all signs of the old infection were rapidly disappearing and there was no new infection.

The first irrigation of the new, small experiment with Bananas was completed and a second irrigation made. The manured blocks received sulphate of ammonia, superphosphate and murate of potash, to supply a complete manure. A few of the plants have flowered; a record will be kept of flowering and fruiting for each plant.

A trial of Shipment of Bananas as deck cargo was made with the kind assistance of the General Manager of one of the firms in Freetown; but the fruits were rotten by the tenth day of the voyage. In furtherance of the trial, two single crates were shipped as free cargo by courtesy of Messrs. Elder Dempster & Co., by *s.s.* "Aba," on November 6 to Messrs. Guerra, Fruit Importers, Long Acre, whose interest was obtained by the firm just indicated. Messrs. Guerra's report stated that the packing of the fruit was excellent in every way and that it arrived in excellent condition, green, though slightly chilled on account of its having been

carried at a temperature of from 45 to 50 F. A range of from 50 to 51 was suggested as a more suitable temperature. The stalks were said to have arrived in perfect condition and the fingers to have remained firmly attached to them; but a subsequent report stated that certain defects, especially a diseased condition of the skin had developed later. A second consignment of two single crates was shipped by *s.s.* "Adda," on December 5. The report from the same firm stated that the fruit seemed to be in much better condition than that of the first shipment, but that the "skin disease" was again observed and their lightness and the small number of fingers on a bunch was a serious handicap to successful marketing (a result to be expected with unirrigated bananas produced during the dry season).

Three additional kinds of AVOCADOS from different parts of the country were planted, and all the vacant positions due to losses were supplied. By the end of the year most of the plants had become fairly established. Imported varieties, namely six plants each of Fuerte, Panchoy Queen and Linda, were received from the Armstrong Nurseries, California, on September 16 and planted on the 17th. These were shaded and watered but by the end of the year 5 Fuerte, 2 Queen and 2 of the Linda had died; and the survival of the remainder was doubtful.

The PINEAPPLES under observation now consist of Queen from the Gold Coast, Smooth Cayenne from French Guinea and Red Spanish from Njala. All are vigorous but not bearing yet.

The upkeep of buildings and roads, and the drainage of swampy stream-beds, were given due attention.

E. S. GARNER,
Agricultural Officer.

MASANKI OIL-PALM PLANTATION.

At the beginning of the year the Plantation was in charge of Mr. I. G. C. Squire, Acting Manager, until he proceeded on leave and transfer, on July 22, charge then being taken by Mr. W. F. Williams, European Overseer, until December 1, when he went on leave and Mr. M. Vardy took over.

The making of the Plantation has now been completed. Work in the field for the first two months of the year was burning off the newly cleared and brushed areas and lining out in readiness for holing. Rebrushing was carried out where necessary in the planted plots. Early in the dry season the usual fire-trace was made along both sides of the railway, and more frequented roads and paths were cleaned, as a further precaution against fire.

The lining out and staking for 1931 planting was started in January and completed in March, holing being now begun, and supplying pit-stuff carried on throughout April and May. Planting started in May and was completed in August. Besides

completing first planting in Blocks III and IV, there was the supplying of some 11,000 palms in all four blocks to replace casualties caused by rats in most cases. On account of the damage and the loss of palms through this cause it may be necessary to maintain the nursery for another year or two. Five hundred and thirty-six palms of LISOMBE were planted in Block III/2 west, at 26′ × 26′, in October.

In January the number of palms required to complete planting were Henoi, 2,000; Nigerian A, 41,000; Nigerian B, 500; Deli, 250. The situation was well in hand and at that time there was a surplus of Henoi, 12,000; Nigerian A, 10,000; Nigerian B, 50,000.

In regard to PESTS, records show that 1,801 palms were destroyed by rats during the twelve months, and that the number of rats dug out after gassing with Cyanogas "A" was 3,677. LOCUSTS settled in the swamps and in the protective belts of bush near the Deli block on January 31, but were in flight again next day, without having caused damage. Several swarms passed over the Plantation during February, similarly without damage. The roving gang has kept young GRASSHOPPERS in check. Sweeping them off the palm fronds by means of hand-nets is found to be the most effective control, early morning being the best time.

The state of the Plantation as regards DISEASE is good. In October it was noticed that some of the palms had a contorted appearance, especially those in Block I, and this caused suspicion of Crown Disease. The Director gave instructions that monthly reports were to contain a record of the number of palms apparently affected by this disease. On November 16, the Acting Manager reported that careful examination by him showed that none of the symptoms of the disease were present, tornadoes being the cause of the damage, from which more than one-half of the palms had recovered.

With reference to the use of COVER CROPS, following instructions from the Director, seed of *Calopogonium mucunoides* continued to be sown round patches of lalang grass when the rains began, for this plant forms a dense cover and is effective in limiting the spread of the weed. Seed harvested for sowing in 1932 amounted to over 24 cwt.

PLANT DISTRIBUTION comprised 8,605 seedling oil-palms for the Agricultural Circles and 250 suckers of Canary banana to Mabang Agricultural Academy.

MAINTENANCE has included chiefly upkeep of roads and bridges and attention to sanitation to the satisfaction of the medical officer.

M. VARDY,
Acting Manager.

Appendix I.

DISTRIBUTION OF PLANTING MATERIAL, 1931.

———	Northern and North-western Circles.	Western Circle.	Eastern Circle.	Njala Agricultural Station.	Masanki Plantation.	Newton Farm.
Banana, Canary (suckers)	220	—	—	—	250	1,122
Breadfruit	10	—	—	—	—	—
Cacao, pods	380	—	—	—	—	—
Cacao, seedlings ...	800	—	511	374	—	—
Cassava, Mayungbe, sticks, bundles	30	—	6	22	—	—
Cassava, Two-cent, sticks, bundles	—	—	36	—	—	—
Coffee, Canephora, seed, lb.	120	28	—	—	—	—
„ „ seedlings	600	—	—	—	—	—
„ Liberian, seedlings	—	—	—	93	—	—
„ Robusta, seeds, lb.	—	15	54	459	—	—
„ „ seedlings ...	—	27,833	—	5,965	—	—
„ Stenophylla, seedlings	—	1,872	531	2,477	—	—
Coconut, seedlings ...	10	274	—	—	—	—
Kola, seedlings	50	—	—	138	—	—
Oil-palm, Nigerian, seeds cwt.	6	—	7	11¼	—	—
Oil-palm, Nigerian, seedlings	640	4,420	1,000	11,630	8,480	—
Oil-palm, Henoi, seedlings	—	—	500	—	—	—

DISTRIBUTION OF PLANTING MATERIAL, 1931—*continued.*

———	Northern and North-western Circles.	Western Circle.	Eastern Circle.	Njala Agricultural Station.	Masanki Plantation.	Newton Farm.
Plantain (suckers) ...	100	—	—	—	—	—
Sweet potato (vines) bundles	22	—	—	—	—	—
Rice, Pa D.C., bushels ...	25	14	70	—	—	—
„ Pa Litoma, bushels	100	—	—	—	—	—
Yams, Chinese, lb. ...	200	112	297	873	—	—
„ Yellow, lb. ...	600	—	—	—	—	—
Ginger, lb.	—	240	496	456	—	—
Lime, Sierra Leone, seedlings	—	240	—	—	—	586
Lime, Dominica, seeds, bushels	—	—	—	12	—	—
Lime, Dominica, seedlings	—	—	—	—	—	631
Calopogonium, seeds, lb. ...	—	—	—	160	—	—
Beans, Bengal, lb. ...	—	—	—	12	—	—

Appendix II.

RAINFALL, 1931.

—	Northern Circle.			Western Circle.					Eastern Circle.				Colony.		
	Batkanu.	Kabala	Makump.	Bonthe.	Masanki.	Moyamba.	Koyeima.	Njala.	Banumbu	Jaiama.	Kailahun.	Segbwema	Hill Station.	Kissy.	Newton.
January	1·85	1·47	1·50	0·20	Nil	Nil	—	0·05	0·48	—	—	—	2·19	1·01	0·01
February	Nil	Nil	0·53	1·00	0·15	0 19	–	0·79	1·65	—	-	—	Nil	Nil	Nil
March	2·92	2·39	3·55	1·24	1·20	1·49	—	3·66	3·73	—	—	—	1·49	2·25	1·36
April	2·35	6·97	5·28	4·16	1·52	4·43	—	6·54	6·90	—	—	—	1·71	1·33	1·44
May	17·87	7·28	13·41	13·74	13·32	11·18		10·57	7·81	—	- -	7·80	12·51	10·22	11·88
June	11·01	16·47	22·58	31·89	13·61	21·08	—	11·44	10·41	—	-	8·94	19·88	14·07	18·11
July	25·01	15·20	20·65	30·82	15·32	14·26	15·37	14·27	15·97	15·26	—	13·92	55·46	34·95	22·99
August	16·32	11·39	24·82	39·04	31·37	19·41	40·46	21·49	12·43	14·98	11·50	10·71	43·04	29·28	32·01
September	18·22	11·59	24·78	19·28	31·17	23·20	41·26	21·97	11·74	15·42	12·88	10·71	34·78	24·29	25·02
October	14·59	11·38	12·76	18·40	14·16	10·69	12·35	10·09	9·01	11·87	9·22	9·06	10·71	12·70	9·29
November	5·05	3·66	8·40	5·48	4·23	6·28	3·89	4·81	6·66	5·52	4·52	5·55	3·85	6·67	3·15
December	0·21	0·43	2·50	2·80	1·44	—	1·58	3·02	4·26	0·03	5·21	1·90	3·96	0·40	0·75
Total	115·40	88·23	140·76	168·05	127·49	—	—	108·70	91·05	—	—	—	189·58	136·57	126·01

Appendix III.

REVENUE.

	£	s.	d.	£	s.	d.
LICENCES:						
Produce	1,030	6	0			
Fines for contravention of Produce Ordinance ...	119	7	0			
Verification of weights and measures	47	15	0			
Departmental fines	1	7	6	1,198	15	6
FEES OF COURT OR OFFICE, ETC.:						
Sale of Government stores ...	29	17	2			
Sale of produce	68	12	0			
Sales, Fruit Farm, Newton ...	119	9	0			
Sales, Oil-palm Plantation, Masanki	60	1	0	277	19	2
Total				£1,476	14	8

Appendix IVA.

OIL-PALM INVESTIGATIONS, NJALA.

NIGERIAN OIL-PALMS, 1931.

—	Yield of A.				Yield of B.				Yield of C.				Yield of D.			
	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, lb.	Weight of fruit, lb.	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, lb.	Weight of fruit, lb.	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, lb.	Weight of fruit, lb.	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, lb.	Weight of fruit, lb.
January	8	10	138	62	10	11	192	116	1	1	16	10	—	—	—	—
February ...	30	39	553	308	34	51	807	511	—	—	—	—	—	—	—	—
March	64	126	1,804	990	67	127	2,301	1,559	6	11	177	110	—	—	—	—
April	59	138	1,967	1,144	64	123	2,421	1,625	8	13	273	165	1	3	59	42
May	49	102	1,563	889	49	112	1,858	1,191	3	7	119	79	1	2	38	28
June	22	34	450	231	22	39	514	300	5	10	152	85	—	—	—	—
July	20	26	419	236	21	30	523	321	4	5	81	44	—	—	—	—
August	37	49	694	382	35	50	834	508	4	6	103	66	—	—	—	—
September ...	51	74	1,038	607	56	89	1,652	1,073	4	5	52	37	—	—	—	—
October	48	63	982	587	36	43	893	585	5	7	163	94	—	—	—	—
November ...	36	43	853	526	26	32	700	468	4	7	106	65	—	—	—	—
December ..	33	40	695	396	28	38	817	536	2	4	58	31	—	—	—	—

Appendix IVB.

NIGERIAN OIL-PALMS, 1931.

YIELD OF WHOLE PLANTATION.

	Number of trees from which heads were harvested.	Number of heads harvested.			Weight of good heads harvested, lb.	Weight of fruit, lb.
January	19	22	4 blind	26	345	188
February	64	90	44 „	134	1,359	819
March	137	264	22 „	286	4,281	2,658
April	132	277	12 „	289	4,720	2,977
May	102	223	9 „	232	3,577	2,187
June	49	83	13 „	96	1,116	616
July	45	61	6 „	67	1,023	501
August	76	105	8 „	113	1,632	957
September	111	168	16 „	184	2,752	1,717
October	89	113	6 „	119	2,037	1,265
November	66	82	5 „	87	1,659	1,059
December	63	82	6 „	88	1,570	963
Total	137	1,570	151 blind	1,721	26,071	16,007

Appendix IVc.

NIGERIAN OIL-PALMS, 1931.

Comparative Yield of Trees in the Plantation.

Yield in lb. of fruit.		0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	110–120	120–130	130–140	140–150	150–160	160–170	Total number of trees in the plot bearing in 1931.
Actual plot figures.	A	9	10	29	24	21	22	12	5	7	4	—	1	—	—	1	—	—	145
	B	7	9	19	20	18	16	22	13	11	6	2	6	4	1	1	—	1	156
	C	—	1	—	4	3	1	3	1	1	—	1	—	—	—	—	—	—	15
	D	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1
	Total (Whole plot) ...	16	20	48	48	42	39	38	20	19	10	3	7	4	1	2	—	1	317
Percentage of total number of bearing trees in the plot.	A	6·2	6·9	20·0	16·5	14·5	15·2	8·3	3·5	4·8	2·8	—	0·7	—	—	0·7	—	—	
	B	4·5	5·8	12·2	12·8	11·5	10·3	14·1	8·3	7·1	3·8	1·3	3·8	2·6	0·6	0·6	–	0·6	
	Whole Plantation ...	5·0	6·3	15·1	15·1	13·2	12·3	12·0	6·3	6·0	3·2	0·9	2·2	1·3	0·3	0·6	—	0·3	

Note.—Four A type and three B trees did not bear fruit in 1931 and are not included above.

Appendix IVD.

NIGERIAN OIL-PALMS, 1931.

COMPARISON OF TOTAL YIELD OF FRUIT OF INDIVIDUAL TREES IN THE PLANTATION FOR THE SIX YEARS, 1926–1931.

Yield in lb. of fruit.	0–50	50–100	100–150	150–200	200–250	250–300	300–350	350–400	400–450	450–500	500–550	550–600	600–650	Total number of trees in the plot bearing.
A	11	16	17	34	35	27	6	3	—	—	—	—	—	149
B	9	—	14	22	33	33	23	7	15	1	—	1	1	159
C	—	1	2	4	3	2	3	—	—	—	—	—	—	15
D	—	—	—	—	—	1	—	—	—	—	—	—	—	1
Total ...	20	17	33	60	71	63	32	10	15	1	—	1	1	324

Ten trees have not yet borne fruits.

Appendix IVe.

NIGERIAN OIL-PALMS, 1931.

	Average Weight, Head. lb.	Average Weight, Fruit per Head. lb.	Percentage Fruit in Head.
January—A ...	13·8	6·2	45
B ...	17·4	10·5	60
Whole Plot ...	15·7	8·6	55
February—A ...	14·2	7·9	56
B ...	15·8	10·0	63
Whole Plot ...	15·1	9·1	60
March—A ...	14·3	7·9	55
B	18·1	12·3	68
Whole Plot ...	16·2	10·1	62
April—A	14.3	8·3	58
B	19·7	13·2	67
Whole Plot ...	17·0	10·8	63
May—A	15·3	8·7	57
B	16·6	10·6	64
Whole Plot ...	16·1	9·8	61
June—A	13·3	6·6	51
B	13·2	7·8	58
Whole Plot ...	13·4	7·4	52
July—A	16·1	9·1	56
B	17·4	10·7	61
Whole Plot ...	16·8	9·9	59
August—A	14·2	7·6	55
B	16·7	10·2	61
Whole Plot ...	15·6	9·1	59
September—A ...	14·0	8·3	59
B ...	18·6	12·1	65
Whole Plot ...	16·4	10·2	62
October—A	15·6	9·3	60
B	20·8	13·6	66
Whole Plot ...	18·0	11·2	62
November—A ...	19·8	12·3	62
B ...	21·9	14·6	67
Whole Plot ...	20·3	12·9	64
December—A ...	17·4	9·9	57
B ...	21·5	14·1	66
Whole Plot ...	19·1	11·8	61

Appendix IV$_F$.

NIGERIAN OIL-PALMS, 1931.

	Average Yield of Fruit per Tree.		Average Yield of Fruit per Acre (at 75 trees).	
	A (Number of trees fruiting, 145)	B (Number of trees fruiting, 156)	A	B
	lb.	lb.	lb.	lb.
January	0·4	0·8	32	56
February ...	2·1	3·3	159	246
March	6·8	10·0	512	750
April	7·9	10·4	590	779
May	6·1	7·6	460	573
June	1·6	1·9	119	144
July	1·6	2·1	122	154
August	2·6	3·3	198	244
September ...	4·2	6·9	314	516
October	4·1	3·8	304	281
November ...	3·6	3·0	272	225
December ...	2·8	3·4	205	258
Whole year ...	43·8	56·5	3,287	4,226

Average yield over all of fruit per fruiting tree, 50·5 lb. (Number of trees fruiting, 37.)

Average yield over all of fruit per acre (at 715 trees) 3,787 lb.

Appendix IVG.

NIGERIAN OIL-PALMS, 1931.

Male and Female Inflorescences at Anthesis in Different Months.

	Number of male inflorescences at anthesis.	Number of female inflorescences at anthesis.	Ratio of male to female inflorescences at anthesis.
January	549	170	3·2
February	402	73	5·5
March	320	140	2·3
April	263	184	1·4
May	215	131	1·6
June	91	161	0·6
July	96	83	1·2
August	228	130	1·7
September	413	277	1·9
October	643	366	1·9
November	619	217	2·9
December	570	85	6·7
Total for the year	4,409	1,987	2·2

Appendix IVH.

KAWEI OIL-PALMS, 1931.

(162 trees, in their 7th year after planting.)

—	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of good heads harvested, lb.	Weight of fruit, lb.	Number of female inflorescences at anthesis	Number on male inflorescences at anthesis.
January ...	—	0 + 12 blind = 12	—	—	167	59
February ...	12	24 + 4 „ = 28	99	58	86	37
March	52	131 + 14 „ = 145	408	259	94	22
April	72	205 + 11 „ = 216	814	493	95	22
May	84	219 + 4 „ = 223	1,067	687	35	56
June	70	152 + 3 „ = 155	715	447	26	20
July	52	91 + 8 „ = 99	479	303	38	52
August	52	81 + 3 „ = 84	415	268	109	237
September ...	58	120 + 1 „ = 121	725	486	141	383
October	23	34 + 7 „ = 41	191	120	216	411
November ...	15	24 + 1 „ = 25	153	105	175	224
December ...	6	9 + 0 „ = 9	68	44	171	14
Total ...	152	1,090 + 68 blind = 1,158	5,134	3,270	1,351	1,597

NOTE.—Nine other trees have borne fruit before, but did not bear in 1931.

Appendix IVJ.

HENOI OIL-PALMS, 1931.

(104 trees, their 7th year after planting.)

—	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of good heads harvested, lb.	Weight of fruit, lb.	Number of female inflorescences at anthesis.	Number of male inflorescences at anthesis.
January ...	13	25 + 27 blind = 52	43	21	69	5
February ...	46	116 + 19 „ = 135	258	134	11	1
March	70	225 + 33 „ = 258	543	297	21	7
April	87	282 + 53 „ = 335	734	401	28	21
May	52	151 + 13 „ = 164	396	214	12	12
June	15	20 + 4 „ = 24	47	22	21	10
July	3	3 + 6 „ = 9	6	4	16	43
August	5	8 + 1 „ = 9	15	6	113	180
September ...	8	12 + 3 „ = 15	33	18	109	183
October ...	8	19 + 3 „ = 22	72	41	209	146
November ...	8	12 + 11 „ = 23	37	22	134	21
December ...	6	13 + 4 „ = 17	63	41	47	13
Total ...	100	886 +177 blind = 1,063	2,247	1,221	790	642

NOTE.—One other tree bore fruit in 1930, but did not bear in 1931.

Appendix IVK.

KPOLEI OIL-PALMS, 1931.

(74 trees. in their 6th year after planting.)

—	Number of trees from which heads were harvested.	Nnmber of heads harvested	Weight of good heads harvested, lb.	Weight of fruit, lb.	Number of female inflorescences at anthesis.	Number of male inflorescences at anthesis.
January ...	—	—	—	—	46	15
February ...	8	20 + 6 blind = 26	34	21	9	9
March	32	136 + 19 „ = 155	375	224	21	7
April	46	191 + 10 „ = 201	546	323	3	9
May	45	165 + 10 „ = 175	568	328	1	11
June	31	49 + 5 „ = 54	195	110	1	1
July	17	31 + 2 „ = 33	99	52	4	4
August	5	5 + 0 „ = 5	18	9	34	56
September ...	4	4 + 0 „ = 4	20	13	48	153
October	1	1 + 0 „ = 1	9	6	68	241
November ...	1	1 + 0 „ = 1	15	9	73	152
December ...	1	1 + 0 „ = 1	7	6	55	61
Total ...	63	604 + 52 blind = 656	1,886	1,101	363	719

NOTE.—One other tree bore fruit in 1930, but did not bear in 1931.

Appendix IVL.

ANGOLA OIL-PALMS, 1931.

(6 trees, in their 5th year after planting.)

——	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of good heads harvested, lb.	Weight of fruit, lb.	Number of female inflorescences at anthesis.	Number of male inflorescences at anthesis.
January ...	—	—	—	—	7	4
February ...	2	3 + 0 blind = 3	7	4	5	2
March ...	2	7 + 0 ,, = 7	36	21	3	0
April ...	3	11 + 1 ,, = 12	45	22	3	4
May	4	11 + 0 ,, = 11	40	21	7	8
June	2	4 + 1 ,, = 5	29	19	5	1
July	4	8 + 0 ,, = 8	45	26	4	2
August	3	4 + 0 ,, = 4	21	13	2	4
September ...	1	1 + 1 ,, = 2	5	3	9	9
October ...	3	3 + 2 ,, = 5	28	19	2	20
November ...	3	5 + 0 ,, = 5	31	21	14	6
December ...	2	4 + 0 ,, = 4	54	35	13	4
Total ...	6	61 + 5 blind = 66	301	204	74	64